Paving the way for computers with brain-like energy efficiency

Can we really build computers as energy efficient as the human brain? New research that has succeeded in combining a memory function and a calculation function in one component brings us a step closer to making this a reality.

DIGITAL ECONOMY

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AI is making it possible for machines to do things that were once considered uniquely human. With AI, computers can use logic to solve problems, make decisions, learn from experience and perform human-like tasks. However, they still cannot do this as effectively and energy efficiently as the human brain.

Research conducted with support from the EU-funded TOPSPIN and SpinAge projects has brought scientists a step closer to achieving this goal. “Finding new ways of performing calculations that resemble the brain’s energy-efficient processes has been a major goal of research for decades,” observes Prof. Johan Åkerman of TOPSIN project host University of Gothenburg, Sweden, in a news item posted on the ‘Scienmag’ website. “Cognitive tasks, like image and voice recognition, require significant computer power, and mobile applications, in particular, like mobile phones, drones and satellites, require energy efficient solutions,” continues Prof. Åkerman, who is also the founder and CEO of SpinAge project partner NanOsc, also in Sweden.

The research team succeeded in combining a memory function and a calculation function in one component for the very first time. The achievement is described in their study published in the journal ‘Nature Materials’.

The memory and calculation functions were combined by linking oscillator networks and memristors – the two main tools needed to carry out advanced calculations. Oscillators are described as oscillating circuits capable of performing calculations.

Memristors, short for memory resistors, are electronic devices whose resistance can be programmed and remains stored. In other words, the memristor's resistance performs a memory function by remembering what value it had when the device was powered on.

A major development

Prof. Åkerman comments on the discovery: "This is an important breakthrough because we show that it is possible to combine a memory function with a calculating function in the same component. These components work more like the brain's energy-efficient neural networks, allowing them to become important building blocks in future, more brain-like computers."

As reported in the news item, Prof. Åkerman believes this achievement will lead to the development of technologies that are faster, easier to use and less energy-consuming. Also, the fact that hundreds of components can fit into an area the size of a single bacterium could have a significant impact on smaller applications. "More energy-efficient calculations could lead to new functionality in mobile phones. An example is digital assistants like Siri or Google. Today, all processing is done by servers since the calculations require too much energy for the small size of a phone. If the calculations could instead be performed locally, on the actual phone, they could be done faster and easier without a need to connect to servers."

Prof. Åkerman concludes: "The more energy-efficiently that cognitive calculations can be performed, the more applications become possible. That's why our study really has the potential to advance the field." The TOPSPIN (Topotronic multi-dimensional spin Hall nano-oscillator networks) and SpinAge (Weighted Spintronic-Nano-Oscillator-based Neuromorphic Computing System Assisted by laser for Cognitive Computing) projects end in 2024.

For more information, please see:
TOPSPIN project
SpinAge project

Keywords

TOPSPIN | SpinAge | AI | computer | brain | memory | calculation | memristor | oscillator

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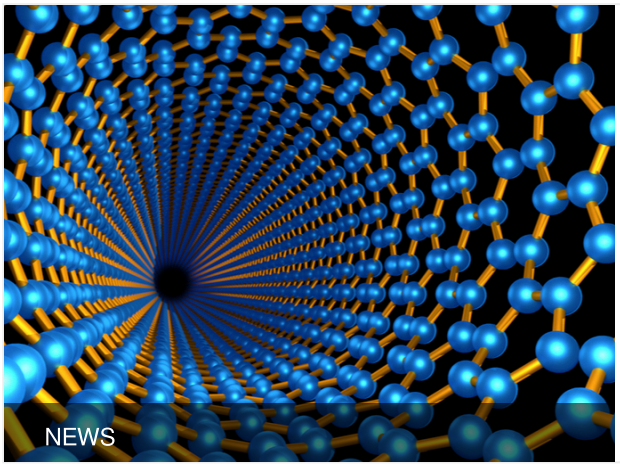

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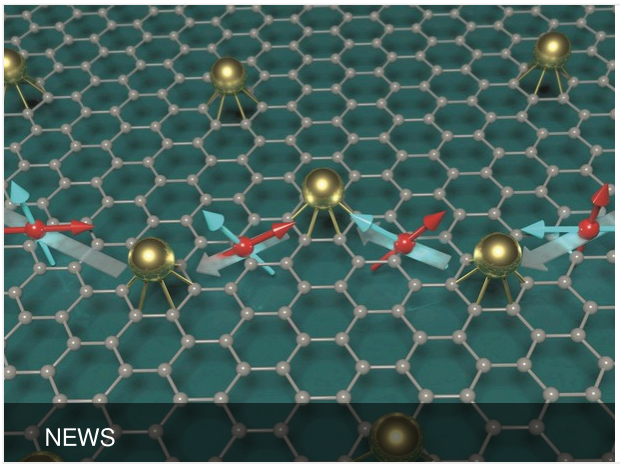

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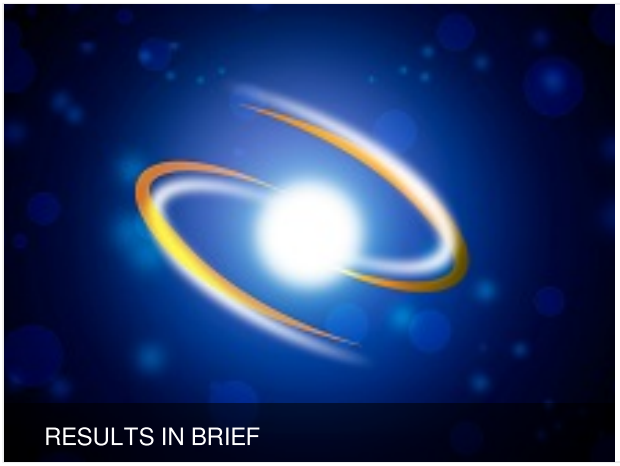

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